UNCONVENTIONAL WIRE CHAMBER WINDING MACHINES AT NAL

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We have designed and built a small and a large wire chamber winding machine at NAL as a facility for constructing and developing spark chambers, proportional chambers and beam profile ion chambers. This facility will also support the present research program carried out by the NAL staff outside of this laboratory. We have built a number of proportional chambers with 0.5 mm, 1 mm and 3 mm wire spacing. The spark chambers were tested successfully. The proportional chamber with 1 mm spacing is being tested at Argonne National Laboratory. Results of these tests will be reported in a different TM. The wire used was 0.8 mm thick Au-plated Mo-wire and the accuracy of the wire spacing with these chambers was better than ±0.01 mm.

The small machine is capable of winding on frames with a maximum size of 14×14 inch^2 (see Fig. 1) and the large machine is built for a maximum size of 10×10 ft.^{2} (see Fig. 2). The large machine has also been successfully operated. We find that the accuracy of the wire spacing is as good as that provided by the small machine. Here we will describe only the large machine because the operation principles are the same for both.

The main frame (F) was constructed of aluminum channels. This frame can easily be taken apart and be mounted on a rigid platform.

The winding frame (WF), on which two chamber frames are attached (one on each side), is rotated by a SLO-SYN motor (R, ROTATOR) whose speed is varied by timing pulleys and timing belts. This speed is typically 2 rpm. The ROTATOR provides a 900-lb. inch torque on the rotating frame. The jaws of the WF are adjusted to the thickness of the chamber frame on which the wire is stretched. A few mils of space may be left between the wire plane and the chamber-frame so that when the wires are glued to this frame, the glue flows under the wires and makes good bonding.

Unlike the CERN[1] and the Brookhaven machines,[2] the wire spacing can be easily and continuously varied from 0.1 mm to a few cm by varying the cut angle between two photodiode - light switches (PL_1 and PL_2) which are fixed around a disk. This method simplifies the machine and does not require grooves or threaded rods to set the wire spacing. A disklike light chopper is attached to a rotating tube and is coaxial with the disk. The photodiodes normally get light from the lens type light bulbs. As the chopper chops the light from one of the photodiodes, another SLO-SYN motor (A, ADVANCER) is turned on by a switching circuit (see Fig. 3). The ADVANCER advances the wire relative to the rotating frame until it is stopped by chopping the light from the other photodiode. This process repeats at each cycle of the rotation. It takes about six hours to wind both sides of two chamber frames of $1 \times 1\ m^2$ size and 1 mm wire spacing.

The tension of the wire which is adjusted by a simple tension device (TD) may be varied from a few grams to a few hundred grams. This device is rigidly attached to the wire feeding plate. The plate (P) moves in steps on a pair of steel rods by a threaded rod which is rotated by the advancer. Two teflon guides (G) are attached to the plate. The wire feeds the tension device to these guides and thence to the rotating frame.

This facility cost about $2000 in parts, and it took about 150 man-hours to build. It will be a useful facility for NAL's present and future detector programs.

REFERENCES

[1] H. Alleyn, et al., CERN 68-34, Nuclear Physics Division (1968).

[2] Private communications.

FIGURE CAPTIONS

Figure 1. Small wire chamber winding machine assembly.

Figure 2. A simplified drawing of the large wire chamber winding machine.

Figure 3. The switching circuit.

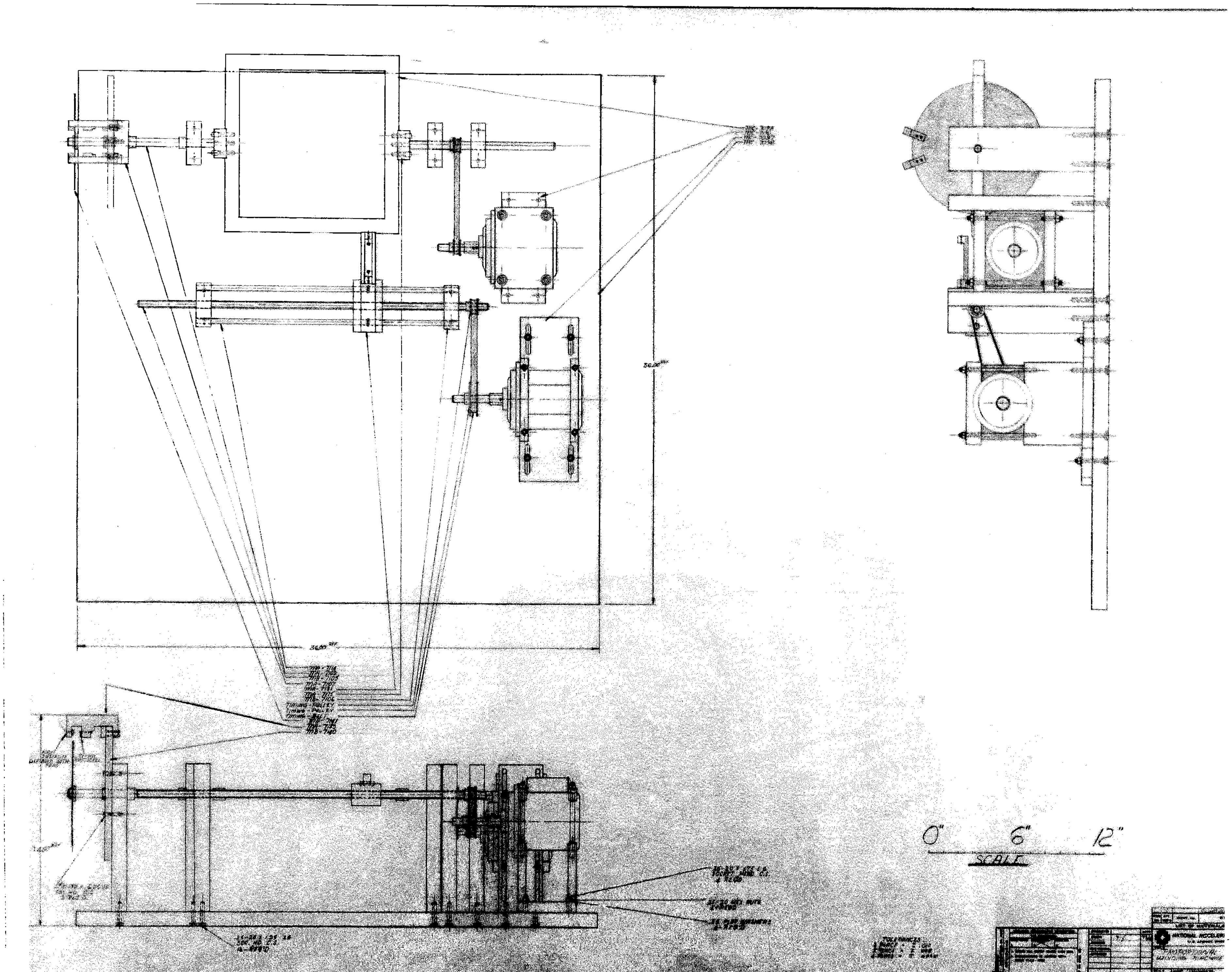
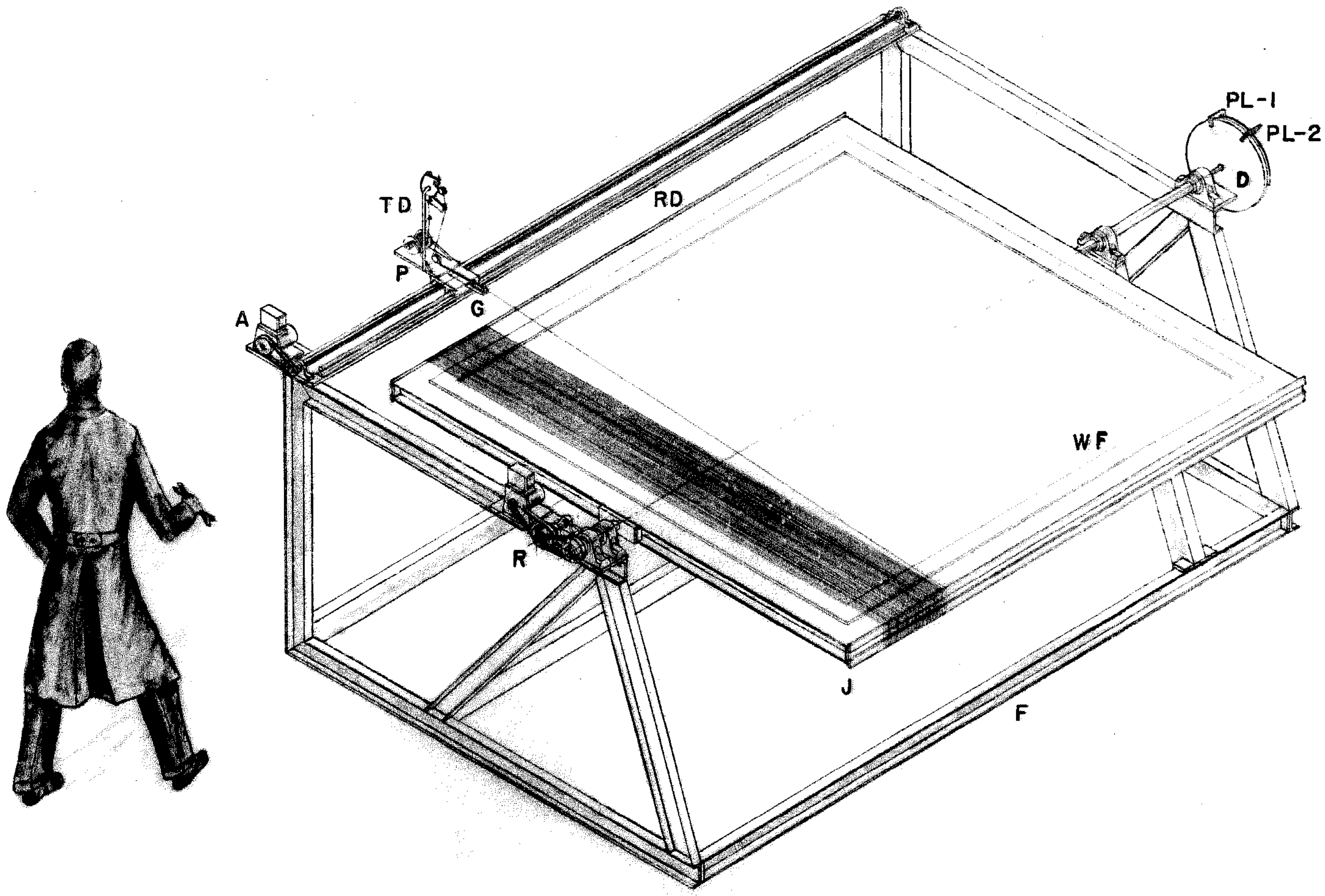


FIGURE I



LIST OF MATERIALS OR PARTS

NATIONAL ACCELERATOR LABORATORY

U.S. ATOMIC ENERGY COMMISSION

FIGURE 2

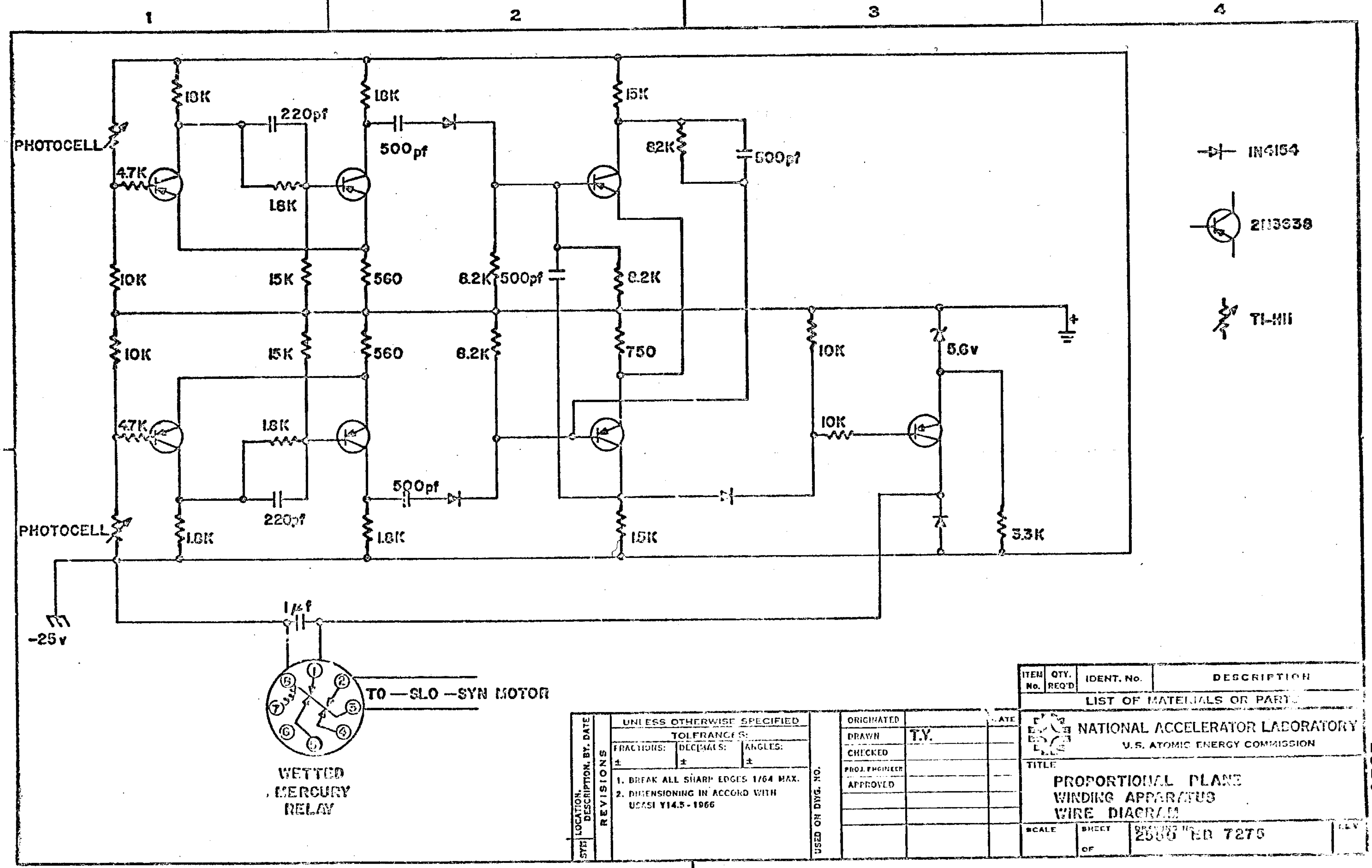

1
2
3
4
PHOTOCELL
PHOTOCELL
10K
10K
10K
10K
4.7K
4.7K
1.8K
1.8K
1.8K
1.8K
220pf
220pf
500pf
500pf
500pf
500pf
15K
15K
15K
15K
560
560
8.2K
8.2K
8.2K
82K
750
5.6v
3.3K
1µf
-25v
IN4154
2N3638
TI-HII
TO —SLO —SYN MOTOR
WETTED MERCURY RELAY
ITEM No.
QTY. REQ'D
IDENT. No.
DESCRIPTION
LIST OF MATERIALS OR PARTS
NATIONAL ACCELERATOR LABORATORY
U.S. ATOMIC ENERGY COMMISSION
TITLE
PROPORTIONAL PLANE
WINDING APPARATUS
WIRE DIAGRAM
SCALE
SHEET
OF
DRAWING NO.
2500 ED 7275
REV
ORIGINATED
DRAWN
T.Y.
CHECKED
PROJ. ENGINEER
APPROVED
DATE
USED ON DWG. NO.
UNLESS OTHERWISE SPECIFIED
TOLERANCES:
FRACTIONS: ±
DECIMALS: ±
ANGLES: ±
1. BREAK ALL SHARP EDGES 1/64 MAX.
2. DIMENSIONING IN ACCORD WITH USASI Y14.5 - 1966
REVISIONS
SYM
LOCATION, DESCRIPTION, BY, DATE

FIGURE 3